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PLANNING AN AIRPORT

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PLANNING AN AIRPORT

Paul H. Stafford

There are a few cities in the United States which require more than one airport. A small airport for general aviation is needed at several thousand communities, but planning of these facilities is relatively simple. Between these extremes, lie the airport planning problems facing several hundred of our cities. This discussion covers the planning of such an airport, handling all airlines and general aviation for its service area.

Planning establishes three basic elements, size, site and shape. For each stage of development of all component parts, the problems are the same—How big? Where? In what form?—The size, the site, the shape.

These three elements are not completely independent. The area needed for the airport will vary with location and configuration. The layout will be influenced by the site. Orderly planning must distinguish between primary requirements and secondary considerations in finding the size, the site and the shape.

The required airport size is determined by the volume and type of traffic. For the planning period, a forecast of activities must be developed. The planner may not hope to be an infallible prophet, but he must base his design on the most accurate appraisal of the business to be accommodated.

Fortunately, there are airports at most of the cities in this group which have accommodated airline and general aviation for several years. The statistical reports can be analyzed, charted and projected.

The length of runway, or airport service type (Feeder, Express, Continental, etc.) is determined by the type or size of aircraft using the airport and not the number of such aircraft. The size and operating range of the maximum aircraft used in airline passenger service at a particular airport depends on the daily number of passengers which can use the economical flight length of this aircraft. If the passenger business is available, the carrier may be expected to provide the proper service.

As a general guide, the C.A.A. established the "Community Airport Requirements," the Service Type of airport required for various combinations of number of enplaned passengers and average length of haul. Other factors are involved, such as route pattern and distribution of long haul traffic. These must be studied to place the airport in the proper service type.

If there are sound reasons for expecting the airport usage to require a larger size in the future, the master plan should be made on that basis. At least one-half mile beyond each end of the runway should be owned or controlled by the airport.

Ideally, the airport should permit landings into the prevailing strong and low visibility winds with flight tangential to the urban development over water, waste-land or agricultural areas. It should be on the side of the city away from smoke travel. It should be in a location where travel to the industrial areas, the business district, and better residential sections of the town can be reached without traversing either of the other areas.

While large investments in the existing airport is often a major factor in site selection, any airport planning job should include consideration of the

proper site. Normally the selection is limited to comparison of a few available locations, each of which falls short of being ideal.

The number of runways required is determined by the volume of air traffic. A single runway with adequate taxiways can handle about 40 aircraft movements (landings and takeoffs) per hour or 100,000 movements per year with very little delay or inconvenience. Operating about this normal capacity has little, if any, effect on safety but causes delay, particularly on takeoffs, during peak periods of activities. When more than a single runway will be required configurations must be selected to estimate the size and study available sites.

While it is realized that most locations will have a small percentage of the time when a single runway cannot be used by some types of aircraft due to cross-wind conditions, studies have shown that this percentage of time is generally very much smaller than the percentage of time during which the airport is unusable by those aircraft due to other weather conditions. The trend of aircraft design is very definitely toward aircraft which were able to operate under practically any cross-wind conditions. It is better to provide more airports and better facilities of other types than to provide additional runways at all airports. The additional traffic which can operate into any airport by reason of multiple runway directions is not sufficient to justify the cost of constructing those runways.

Most of the 6000 airports in the United States have sufficient traffic to justify only one runway. However, there are many which will require additional runways to handle peak traffic without unreasonable delay. Additional runways to handle a volume of traffic can be placed in several configurations. The simplest runway pattern is that of parallel runways adjacent to each other and separated by 500 to 1500 feet. This simple parallel configuration may frequently be used to advantage where light and heavy aircraft each constitute a substantial portion of the traffic. The inner runway, that is, the one closest to the building area, will normally be used by the lighter aircraft and may have less width, length and strength. Traffic patterns for the two types of aircraft will normally be on opposite sides of the field adjacent to the runway to be used by each type.

This same simple parallel configuration can also be used where traffic is generally of the same type, with the inner runway normally being used for landings and the outer runway for take-offs, although both may be used for either purpose when traffic conditions warrant.

The next configuration is in the shape of the letter "H," with the building area lying between the two runways. To reduce taxiing distance, it may be desirable to offset these runways using the left runway for landings and the right for take-offs, unless topography prevents such arrangement. A separation of 3000 to 6000 feet between the parallel runways will normally be used in this design.

A runway configuration which has excellent traffic possibilities is the open "V", with the building area between the two runways and the wide end of the "V" oriented toward the prevailing wind. Landings can be accomplished on either runway while take-offs are in progress on the other without interference. Even under instrument conditions, simultaneous use of the runways can be accomplished with our present navigational equipment. This configuration also allows two runway directions which will be advantageous under some strong wind conditions. Where conditions of topography do not permit either of the foregoing configurations, runways in the pattern of the letter "X" can be used to advantage where traffic control is exercised. Take-offs can

frequently be made from a position adjacent to the terminal building and the interval between landing and take-off can be reduced by alternating the runways in use. While this configuration does not have the flexibility or capacity of the open "V", it can handle considerably more traffic than a single runway.

The terminal or building area of our airport is the doorway from the city to air transportation. Its size, site and shape should make it serve most efficiently for this primary function. It must be convenient to the runway system, convenient to the city, convenient for intra-airport traffic.

On most airports, the various buildings serving passengers, cargo, small plane and maintenance should be grouped on one side of the airport. (The concentration of activities makes it possible to provide more and better service to the users and employees.) Where major maintenance, manufacturing or a large, regular military installation is served, this may be across the runway system.

Normally, the small plane and cargo areas should flank the passenger terminal with aircraft maintenance hangars located adjacent to the cargo area if large planes are maintained, and adjacent to the small planes if only small planes are serviced. Local factors in operations or site pecularities may favor a different scheme.

Circulating roads should provide separate access to the different areas and permit convenient travel between areas. A simple system with one turning choice at a time makes driving easier and reduces congestion.

Air transportation is a growing business. Its ultimate size cannot be predicted with any degree of accuracy since it depends on so many developments; the economic growth, the travel habits of the people and the improvements in speed, reliability and cost of air travel. It is, therefore, not practicable to design or build airport terminal buildings to accommodate the traffic which may be attained in 25 or 50 years. The correct practice is to provide room around the buildings for expansion and to design facilities which can be enlarged from time to time without undue loss in construction costs or lowering of the efficiency of operation.

It appears most economical to construct passenger terminal facilities of a size that will be in keeping with the traffic estimates expected to be attained about ten years after the completion of the building. Enlargement at intervals substantially less than ten years will make construction costs high. During the period when air traffic is growing so rapidly, construction of a terminal building designed for a period greater than ten years will result in a building uneconomical for maintenance during the early period and probably obsolete in some features before the design capacity is reached. Since overloading of a building to the extent of at least 50% above its design capacity can be tolerated without undue discomfort or loss of efficiency, considerable flexibility remains in the choice of time when the building is to be expanded. The extra space may be devoted, until needed, to industrial exhibits or other uses for a source of revenue. If the forecast is in error, the only result is to reach designed capacity in eight or twelve years instead of ten. The enlargement program can be revised or the flexibility of capacity can be used.

As in all planning problems, airport planning must be approached in a direct logical manner. Find the facts, forecast the future and plan for progress.

PROCEEDINGS-SEPARATES

The technical papers published in the past twelve months are presented below. Technical-division sponsorship is indicated by an abbreviation at the end of each Separate Number, the symbols referring to: Air Transport (AT), City Planning (CP), Construction (CO), Engineering Mechanics (EM), Highway (HW), Hydraulics (HY), Irrigation and Drainage (IR), Power (PO), Sanitary Engineering (SA), Soil Mechanics and Foundations (SM), Structural (ST), Surveying and Mapping (SU), and Waterways (WW) divisions. For titles and order coupons, refer to the appropriate issue of "Civil Engineering" or write for a cumulative price list.

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a. Beginning with "Proceedings-Separate No. 200," published in July, 1953, the papers were printed by the photo-offset method.
b. Presented at the Miami Beach (Fla.) Convention of the Society in June, 1953.
c. Presented at the New York (N.Y.) Convention of the Society in October, 1953.
d. Beginning with "Proceedings-Separate No. 290," published in October, 1953, an automatic distribution of papers was inaugurated, as outlined in "Civil Engineering," June, 1953, page 66.
e. Discussion of several papers, grouped by divisions.
f. Presented at the Atlanta (Ga.) Convention of the Society in February, 1954.

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